

NIST Biometric
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Multi-camera Iris Quality Study

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Agenda

- Iris recognition overview
- Study outline
- Results and Analysis
- Conclusions

Iris Template Generation and Matching

1

Capture a digital image of the iris

2

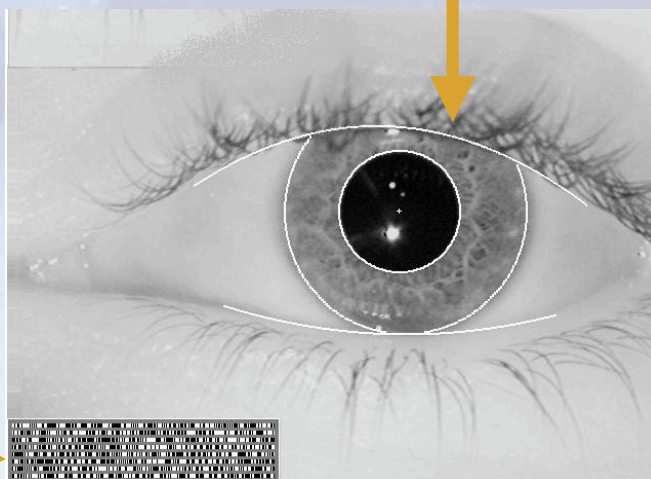
Prepare, process image for analysis

3

Create 688 byte
IrisCode® from iris
texture/ patterns

4

Use IrisCode®
template for
Authentication



Iris Match Metrics

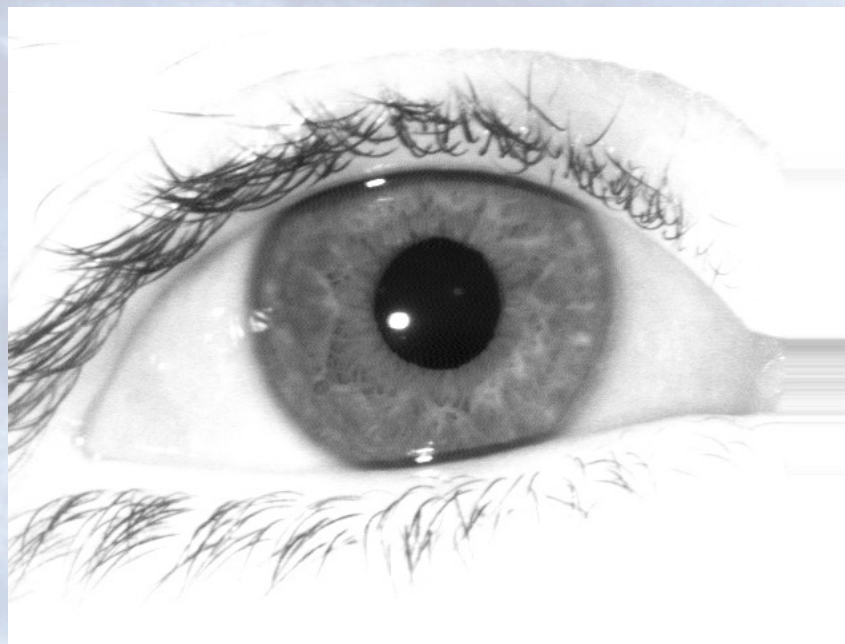
- Templates are fixed-length but have variable number of “usable” bits
- Hamming Distance used as match metric
 - $H_{Draw} = \text{differing bits} / \text{usable bits}$
- Authentication uses “ H_{Dnorm} ” – H_{Draw} adjusted to account for change in imposter statistics if entire iris is not visible

Study Outline

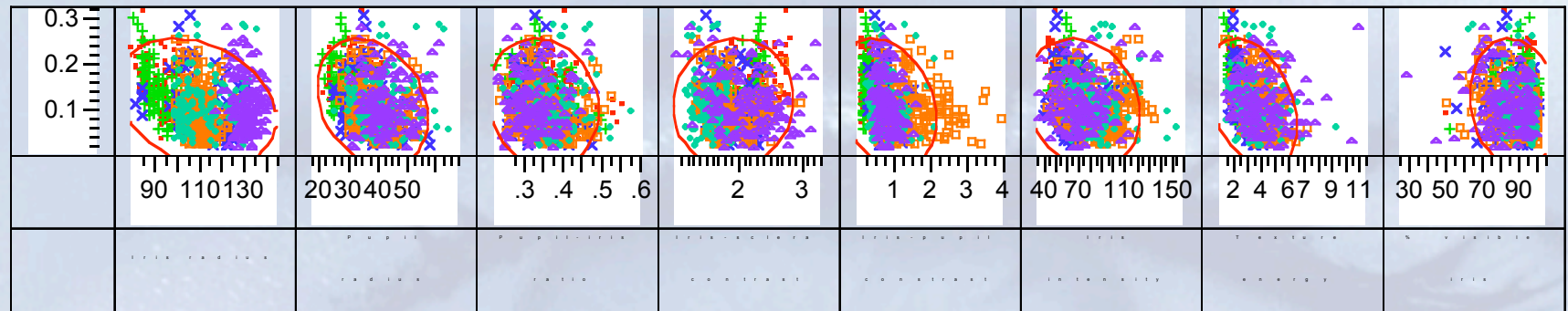
- Six different Iridian-certified iris cameras
 - Single-eye desktop (DT) (3)
 - Single-eye walk-up (SE) (1)
 - Two-eye walk-up (TE) (2)
- 47 subjects
- Enrollment then recognition, each camera
- Same enrollment criteria, all cameras
- Evaluate recognition images and calculate metrics for authentic matches

Iris Quality Metrics

- Iris radius
- Pupil radius
- Pupil-iris ratio
- Iris-sclera contrast
- Iris intensity
- Texture energy
- Visible iris



Correlation of HDraw with all metrics



Camera

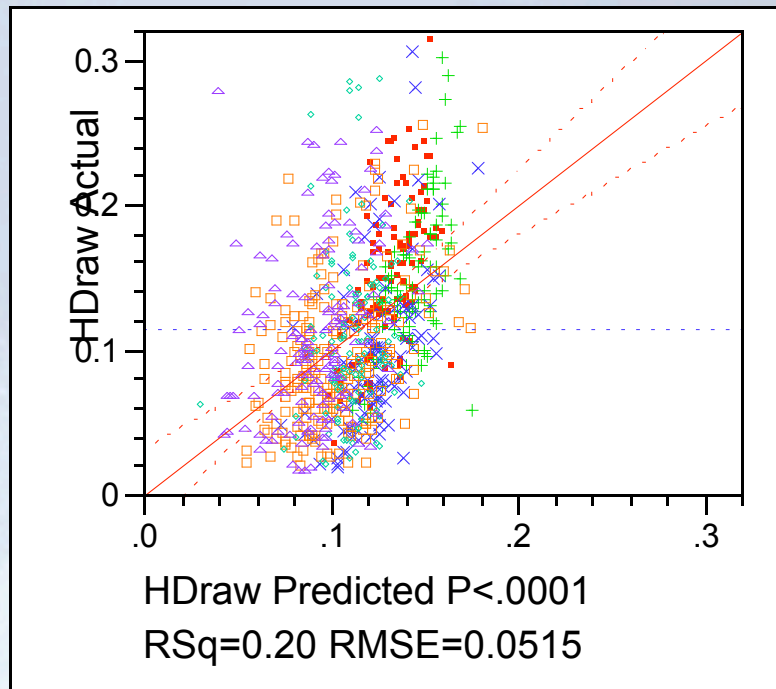
- DT
- DT
- × TE
- SE
- ◆ DT
- ▲ TE

NOTE:

Iris-sclera contrast is not significantly correlated with HDraw

Pupil radius and iris radius are highly correlated

Multivariate Regression



Construct a function to predict HDDraw from quality metrics:

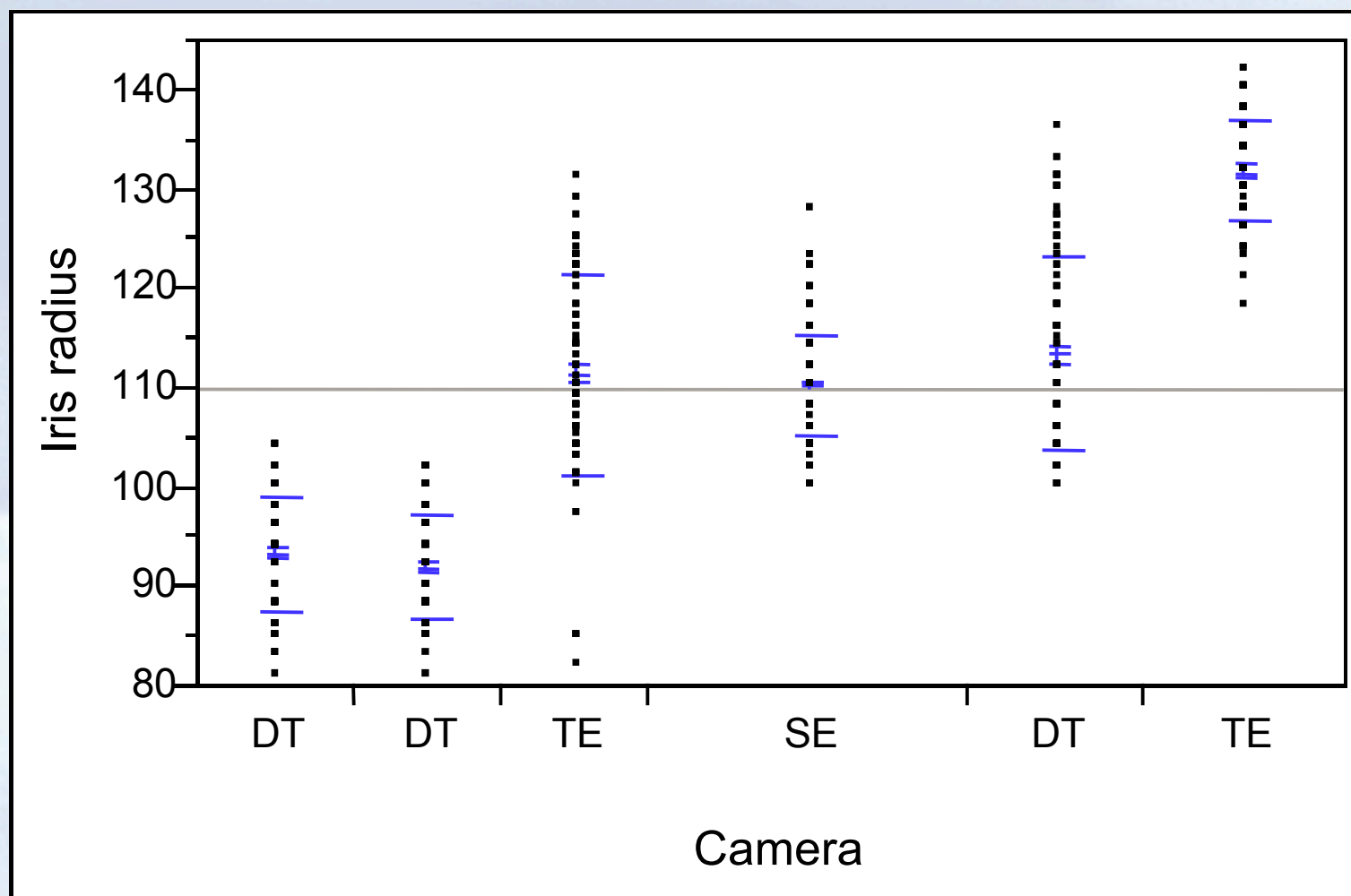
$$Y = a_1x_1 + a_2x_2 + a_3x_3 + \dots + b$$

The predictive value of each metric is reflected in the magnitude of the t-ratios associated with the estimates for the weights a_i :

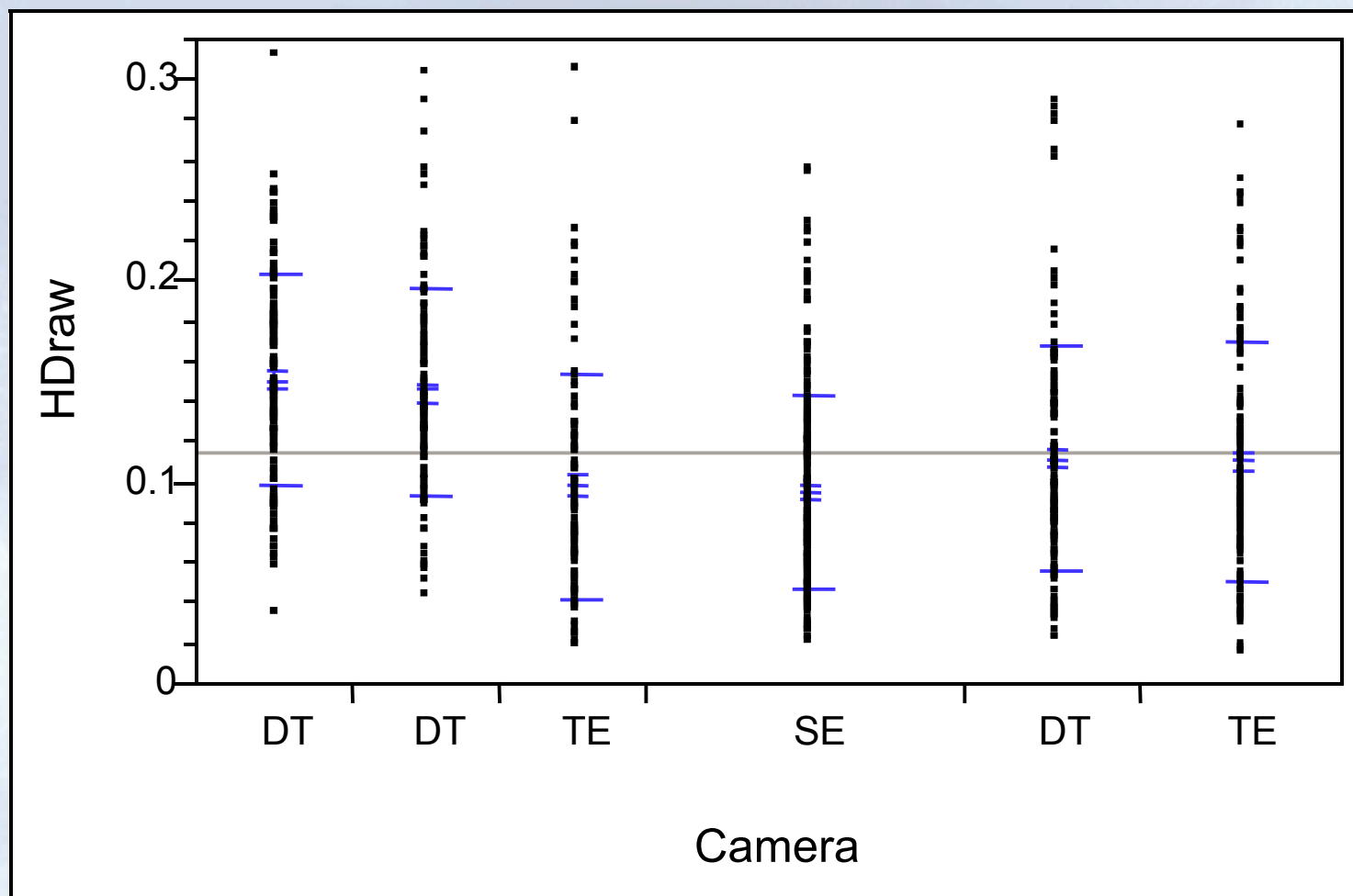
<i>Texture energy</i>	<i>-6.67</i>
<i>% visible iris</i>	<i>-6.12</i>
<i>Iris radius</i>	<i>-4.56</i>
<i>Iris-pupil contrast</i>	<i>-3.61</i>
<i>Iris intensity</i>	<i>2.88</i>
<i>Pupil-iris ratio*</i>	<i>-1.32</i>

**not significant, p-value > 0.05*

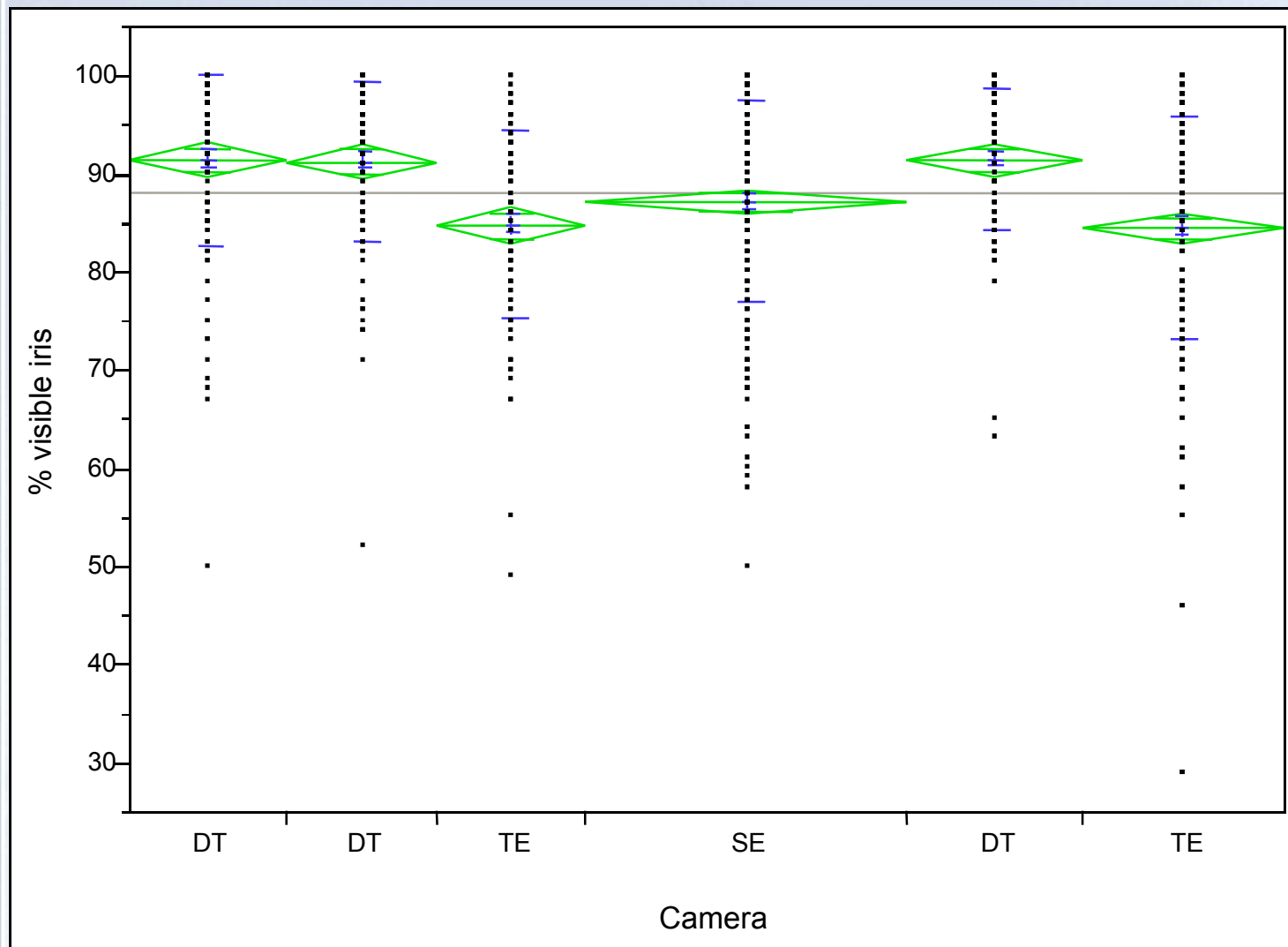
Iris Radius by Camera



HDraw by Camera



User Motivation Matters



Conclusions

- Resolution is important, but not comprehensive
- The most significant quality factors (texture energy, % visible iris) are at least partially subject-specific and behavioral
- Current quality recommendations in ANSI/INCITS 379 and ISO/IEC 19794-6 based on pixel resolution are incomplete and should be revised
- Product selection must be based on
 - Quality
 - Scalability
 - Response Time
 - Security
 - Interoperability
 - Cost
- Should “suitable for purpose” judgments be based on quality scores that are unavoidably subject-dependent?



THANK YOU!

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